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COTTON ANTHRACNOSE

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Introduction

Cotton anthracnose, or boll rot, as it is sometimes called, is a serious enemy of the cotton plant. This disease was first described at the Alabama Station by Atkinson. It causes heavy loss in all the cotton States east of the Mississippi river. Investigations in South Carolina by Barre show that the loss in that State due to this organism probably exceeds $2,000,000 annually. It is evident that this fungus also causes considerable loss in some sections of this State.

Symptoms of the Disease

The organism attacks the bolls, the seedlings and the stems of the plants.

On the boll, small round spots of a dull reddish color are the first indications of the trouble. As the disease progresses the spot gradually enlarges until it covers one-fourth to one-half of the boll. These spots often coalesce and form irregular diseased areas which frequently involve the entire boll. If the weather conditions are favorable, the spots are soon covered with a pinkish coat. In very dry weather this pink covering often fails to form and the spots are gray or black instead of pink. As soon as the organism gains entrance into the boll it spreads rapidly through the lint and seed. When badly diseased bolls are cut open the entire inside is often found discolored and rotten. If the bolls are attacked while quite young they may be killed or the invaded side may be dwarfed while the other side may continue to grow, forming a distorted fruit which usually opens incompletely. Bolls which are not badly diseased, or those which become diseased late in their development, may mature and open normally. The seed in diseased locks are either destroyed completely or penetrated by the disease. Such seed when used for planting is the source of infection for the succeeding crop.

The young seedlings from badly diseased seed are often attacked and killed by the organism before they reach the surface of the ground. During periods of unfavorable weather the fungus may also produce a damping off of seedlings just at the surface of the soil. Usually, however, the entire stem below the surface is dark colored and diseased. During cold, damp spells in the spring entire stands are often killed by this organism.

Cause of Anthracnose

Anthracnose is caused by the fungus, **Glomerella gossyphii**. This organism is a small microscopic mold-like plant which invades the bolls, seed and seedlings. The colorless filaments of the fungus grow into the cells of the plant, kill the tissues, and cause disease. The fungus is reproduced by small seed-like cells called spores. The spores develop by the millions and often form a sticky pink covering over the diseased tissues of seedlings and bolls.

How the Disease Is Spread

The slimy pink spore coating which covers the diseased tissues, on drying, hardens and adheres to the injured tissues. During rainy weather the drops of water dissolve this slimy material and the spores become suspended in the water and are soon scattered about by the wind and rain. Insects and animals coming in contact with the slimy material often have large numbers of the spores sticking to their feet and bodies, and frequently carry the spores from plant to plant.

The cotton gin is also an important source of infection. When a badly diseased lot of cotton is ginned, many spores remain in the machine and adhere to the seed and lint of the next lot of cotton which passes through the gin. Thus seed free from the disease may become thoroughly infected in ginning.

Experiments conducted by Barre show that this organism may remain in the dead bolls and stalks in the field for at least sixteen months. A careful study shows that the filaments and spores of the fungus may also remain alive in the seed for about two years. It is edivent that the fungus is often carried from year to year and place to place in the seed. A careful study of the history of the various outbreaks of anthracnose in South Carolina shows that the disease was shipped in the seed and in a number of cases through seed highly recommended and bought from seed men at a fancy price.

Control Measures

The results of experiments conducted by Barre, Orton and others show that loss due to this organism can be prevented. The following methods have been successfully employed in controlling the disease. Seed selection, crop rotation, old seed and hot water and sulphuric acid seed treatments.

Seed Selection.—The careful selection of seed for uniformity of type and for quality of high commercial value should be a common practice with growers. Since anthracnose is carried in the seed, it is extremely important that the selected seed shall also be free of the disease. Experiments show that by carefully selecting cotton for seed from healthy plants and bolls, one is able to get entirely rid of anthracnose. Select seed only from plants which show no indication of boll rot. After the seed has been carefully selected, great care should be exercised in handling and storing to keep it free from

infection. Gins should be cleaned and disinfected before the selected cotton is ginned.

The greatest care must also be exercised in buying seed so as to be sure that it is free from the disease. So, while we are making an effort to get rid of the organism by careful seed selection, we must also guard against reinfecting our land from diseased seed brought from outside.

Crop Rotation.—A careful study of the life history of anthracnose shows that it may live a year and possibly a little longer on the old dead stalks and bolls left in the field. Consequently the rotation of crops is almost as important a factor as seed selection. It has been found that planting infected land with other crops for one year materially reduces the infection and usually makes it possible to grow cotton on such land the second year. Occasionally, however, a sufficient number of anthracnose spores remain alive to cause serious loss during the second year. Where the cotton is planted for seed purposes it is better practice to keep cotton off the land for at least two years.

Deep fall plowing in connection with the rotation has given excellent results, especially when a chopper is first run over the stalk and the land then carefully plowed so as to completely cover up all the diseased material.

Old Seed.—The results of Barre's work in South Carolina indicate that anthracnose seldom remains alive in the seed longer than two years. There is considerable evidence that three-year-old seed invariably produce seedlings free from the disease. Four and five-year-old seed usually give a fairly high percentage of germination.

It is evident that if the seed is carefully selected and then stored for three years or more the seedlings from such seed will be free from the disease. Some of the eastern growers store all their cotton-seed about three years.

Sulphuric Acid Seed Treatment.—Experiments show that anthracnose and several other boll rots, as well as several leaf spot producing organisms, pass the winter on the lint of the cotton plant. It is evident that if all the lint is removed, and the seed is placed in a disinfectant, infection from this source will be eliminated.

Various methods of removing the lint have been carefully tried out with more or less success. However, the concentrated sulphuric acid treatment reported by Duggar from the Alabama Station in 1911, proved to be the cheapest as well as the most efficient means of delinting the seed.

The seed is placed in a wooden or earthen vessel and then covered with commercial sulphuric acid for about ten or twelve minutes. The seed should be stirred constantly with a wooden ladle until the lint is removed, after which it is poured into a large earthen funnel (sieve) and the acid drawn into a second wooden or earthen vessel. The acid can be used in treating several lots of seed. The seed is

washed in running water for about twenty minutes and then spread out on the floor until dry.

Commercial sulphuric acid costs about 75 cents per gallon. One gallon will treat a little more than one bushel of seed. **(Sulphuric acid is a poison and it will burn clothing as well as the hands.)**

The treated seed are not only much easier to handle in planting, but they germinate better and the plants invariably reach the surface of the ground several days in advance of those not so treated.

Hot Water Seed Treatment.—The hot water treatment will not only eliminate all the anthracnose on the seed and lint, but will also kill out the filaments of the fungus which gain entrance and pass the winter within the seed.

The seed must be treated in small lots so that all of them may quickly and uniformly reach the desired temperature. Two tubs or vats of water should be provided. In one tub (No. 2) the exact temperature required should be maintained. The other tub (No. 1) is used for bringing the seed to the temperature of the treatment, so as not to lower the temperature in tub No. 2. Galvanized iron tubs of about twenty-five to thirty gallons capacity and a kerosene or gasolene double-burner stove are convenient. A sack or basket containing about one peck of seed should be plunged into tub No. 1 for one minute, then transferred to tub No. 2 for fifteen minutes. The temperatures of both tubs should be held as nearly as possible at 149° F. (65° C.). The seed should be kept agitated while in the tub so all seeds will have a uniform temperature. If the temperature rises above 158° F. (70° C.), or falls below 149° F. (65° C.), the time for immersion must be diminished or increased accordingly. A reliable thermometer is necessary since an inaccurate instrument may result in injury to the germinating power of the seed. As soon as the seed have been treated for a sufficient length of time they should be spread out on the floor not more than one or two inches deep until thoroughly dry.

Different varieties of cotton show considerable difference in their behavior to high temperatures. Cook seed treated at 162° F. (72° C.) for eighteen minutes gave a high percentage of germination, while Wannamaker seed treated in exactly the same way gave only 1% of germination. A second lot of Wannamaker seed which was treated at 149° F. (65° C.) for eighteen minutes gave normal germination. Delinted seed also showed more injury from too high a temperature than seed with the lint.

How to Obtain Desirable Disease-Free Seed

The best results can be obtained where the seed used for planting is selected from plants of uniform type which possess qualities of high commercial value. Such seed must be free from anthracnose as well as other disease producing organisms. The best results are obtained where the growers set aside four or five acres of land each year for growing the plants for seed. In order to avoid introducing undesirable characters by crossing with other varieties, and also to

avoid infection from anthracnose and various other parasitic organisms, the breeding plot is usually located some distance from other cotton fields.

Since there is some evidence that anthracnose may live on the dead bolls and twigs in the field for more than one year, rotation of crops is almost as important as seed selection. Cotton should never be planted on land where there was a severe outbreak of anthracnose the previous year, for in such cases the disease will be materially increased the second year. It has been found that planting infected land in other crops for but one year greatly reduces the number of infected plants the second year, but experiments show that anthracnose cannot be completely starved out in less than two years. Consequently a three years' rotation is required for all fields used in growing disease-free seed.

All seed used in planting the seed plot should be carefully selected and free from the various disease producing organisms. If it is impossible to secure disease-free seed, the seed used in planting the plot should be treated in hot water at 158° F. (70° C.) for fifteen minutes. Since the varieties of cotton, and even strains of the same variety, show considerable variation in their behavior to high temperatures, it will be best some time during the winter to treat a small quantity of the seed at 158° F. (70° C.) for fifteen minutes. Then put fifty of the treated and fifty of the untreated seed between moist blotting papers or cheese cloth and place in an incubator at 90° F. (32° C.) for about six days, then compare the germination of the lots of seed. If the percentage of germination in the treated lot is materially reduced, the temperature is too high and the treatment should be lowered to 154° F. (68° C.) for fifteen minutes. If the treatment still reduces the germination, lower the temperature to 149° F. (65° C.) and test the percentage of germination. The higher the temperature, the more effective the treatment.

Plant from five to six seeds in a hill in four-foot checkrows. Save some of the selected seed for replanting. Never replant with any other seed. After the plants are five or six inches high, thin to one plant to a hill, being careful to retain only healthy plants. Examine the plants from time to time and remove all those which show any signs of disease or developed undesirable characters. Just before picking the breeding plot, carefully select and securely mark a number of the healthy plants which show the most uniformly desirable characters. Pick and carefully store this seed for planting the seed plot the following year.

Great care should be exercised in picking the cotton in the seed plot to reject the seed from all bolls showing indications of anthracnose or any other boll rot. Also reject seed from plants which show undesirable characters.

When the seed has been carefully selected for freedom from disease, every precaution should be taken to avoid reinfection. Gins to be used for such seed should be thoroughly cleaned before the seed cotton is ginned.